R. H. LUFKIN.

LEATHER FOLDING MACHINE.

APPLICATION FILED MAY 9, 1906.

962,034.

Patented June 21, 1910.

3 SHEETS—SHEET 1.

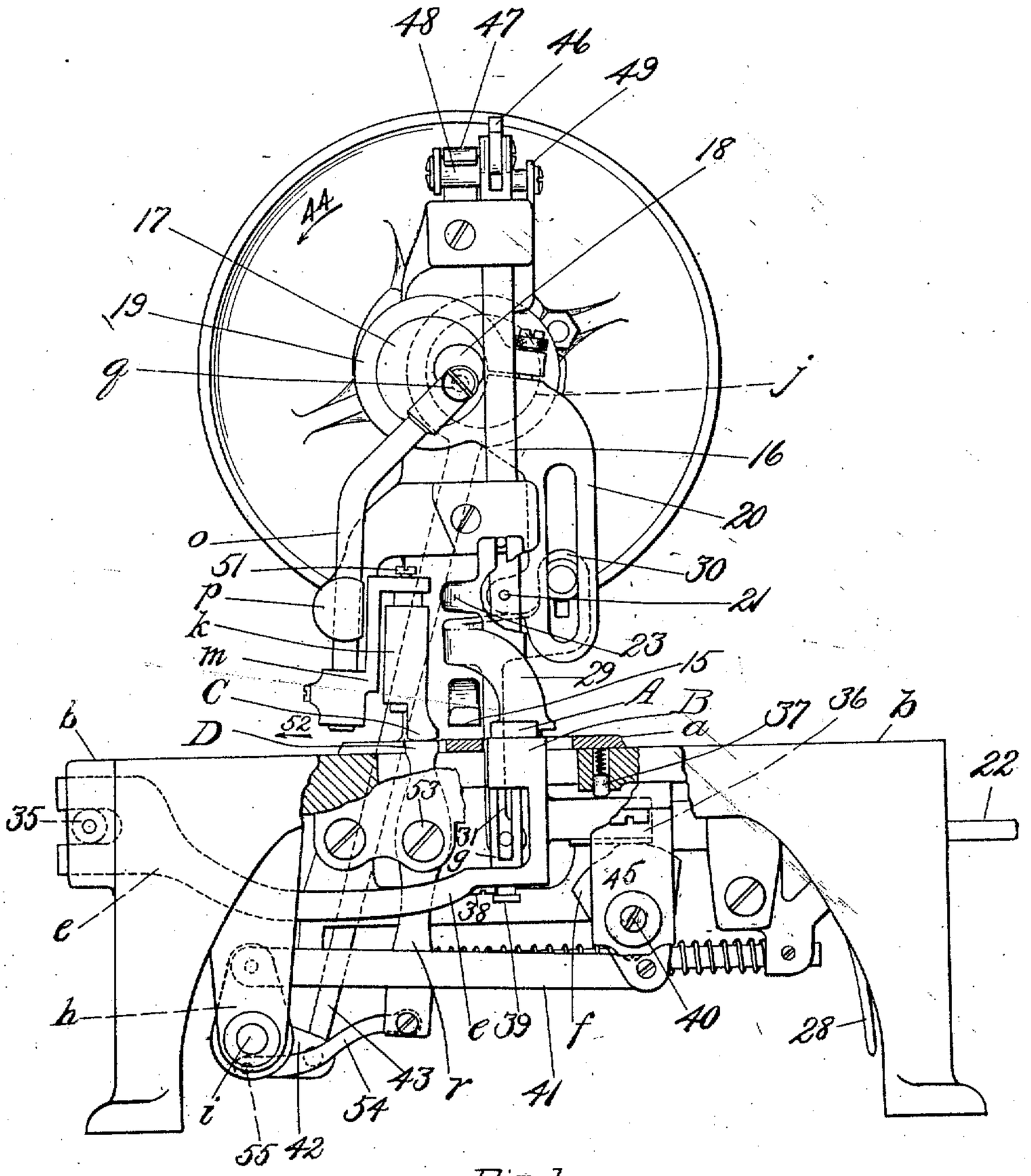

Fig. 1.

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3 SHEETS—SHEET 2.

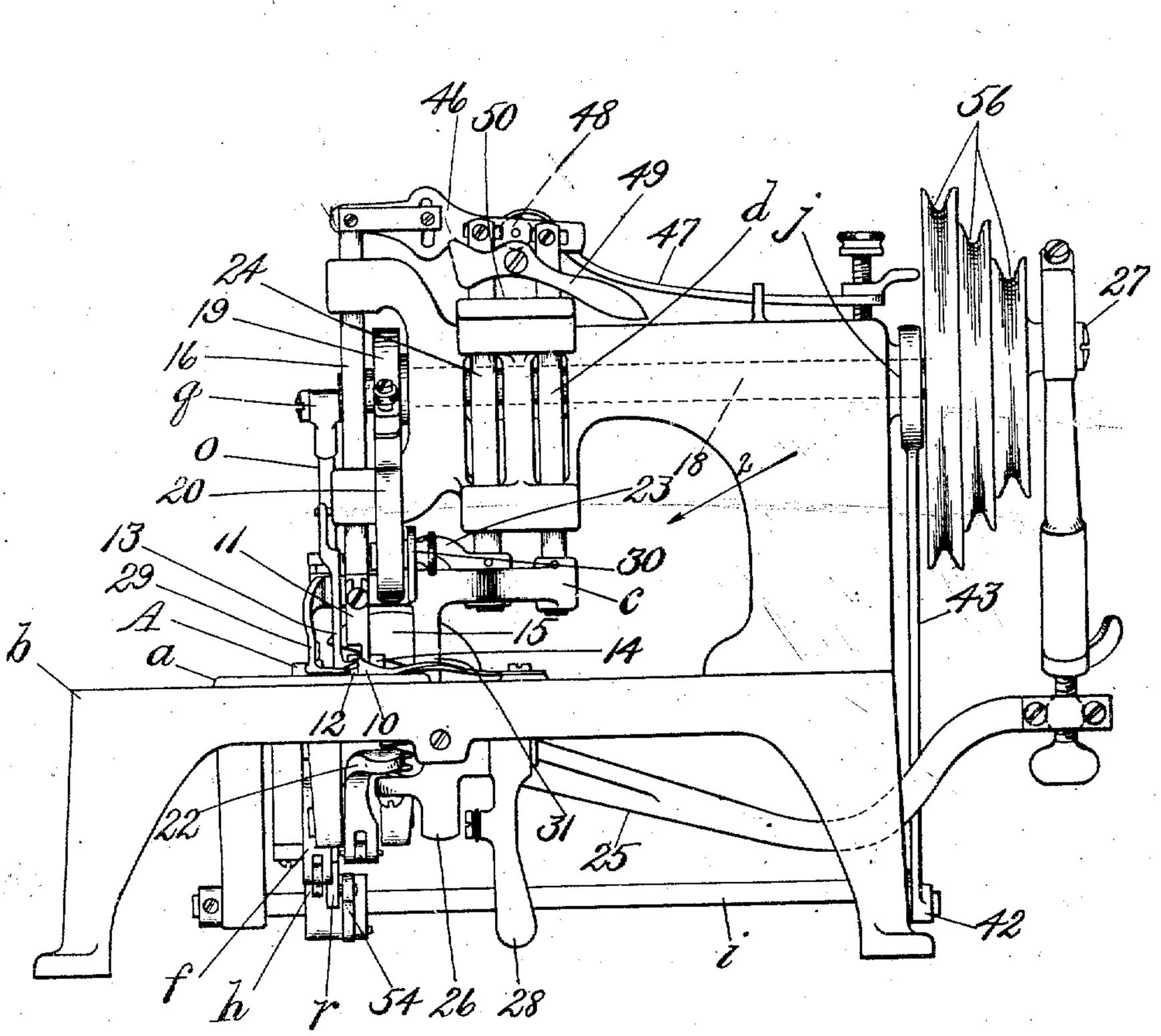

Fig. 2.

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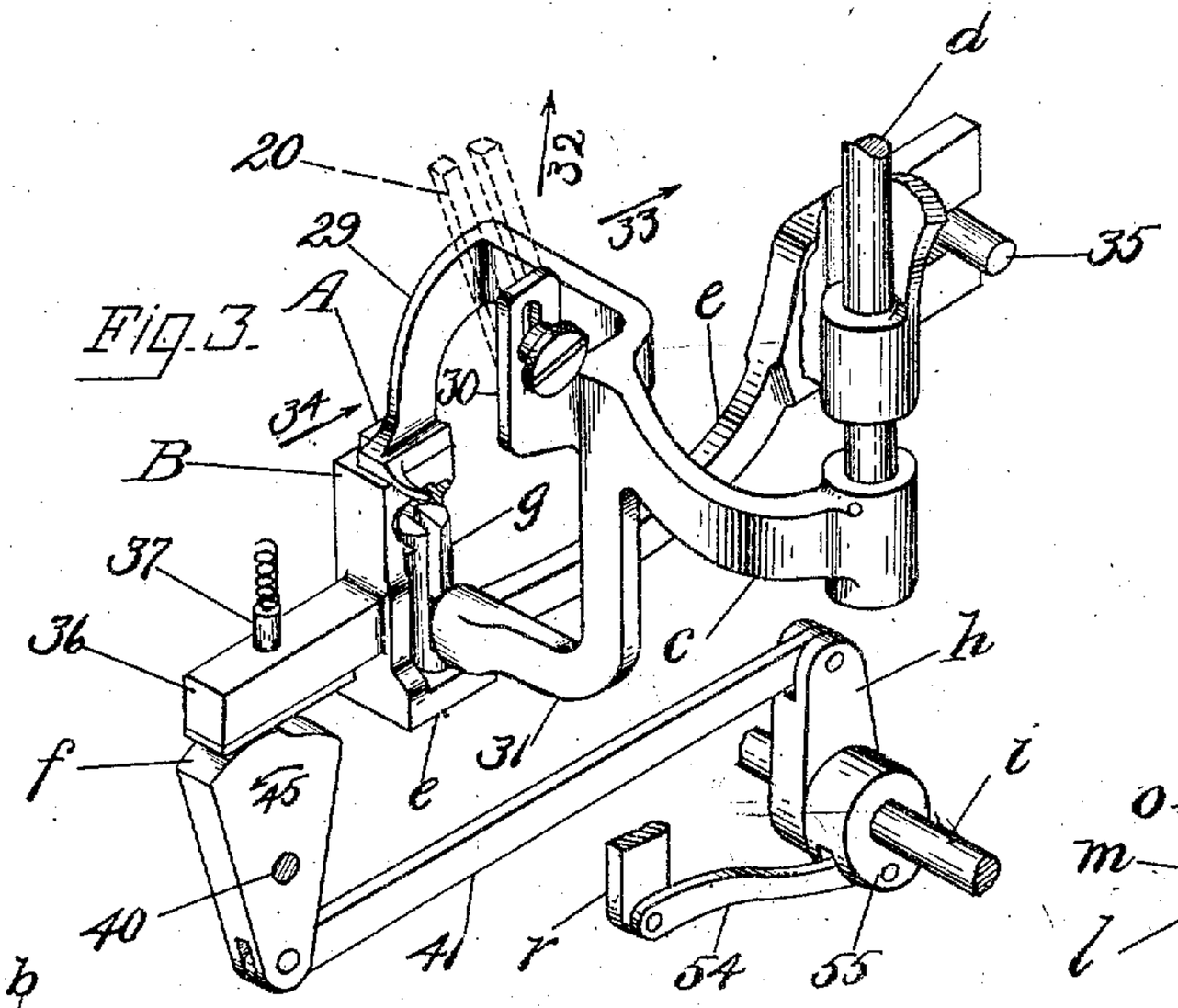
3 SHEETS—SHEET 3.

Fig. 3.



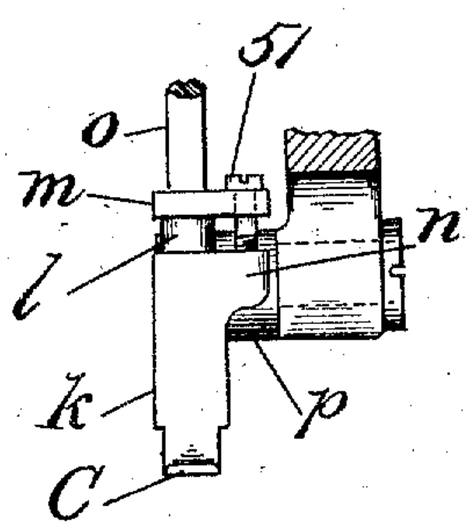


Fig. 5.

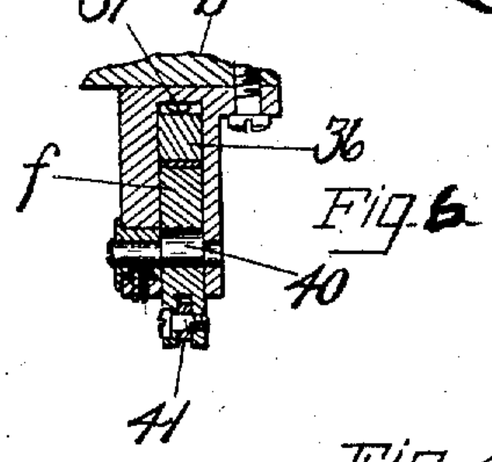


Fig. 6.

Fig. 4.

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RICHARD H. LUFKIN, OF MEDFORD, MASSACHUSETTS.

LEATHER-FOLDING MACHINE.

962,034. Specification of Letters Patent. Patented June 21, 1910.

Application filed May 9, 1906. Serial No. 315,941.

To all whom it may concern:

Be it known that I, RICHARD H. LUFKIN, a citizen of the United States, residing at Medford, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain Improvements in Leather-Folding Machines, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to folding machines wherein the material to be folded is fed so as to present successive portions of its edge to the action of folding means.

More particularly the invention pertains to improvements in the means for manipulating the material preparatory to and during the folding operation; and said improvements are designed primarily to be applied to machines of the type shown and described in United States Letters Patent, Nos. 294,394 and 713,657 granted, respectively, on March 4, 1884 and November 18, 1902.

In machines heretofore used, it has been customary to feed the material intermittently by means of coöperating feeding members, one above the other, which engage the material between them and move in unison to feed it. The upper feeding member has been arranged to retreat from engagement with the material at the completion of a feeding movement, to return thereupon to its initial position, and to reëngage the material for another feeding movement. The lower feeding member has been arranged to return to its initial position by simply retracing the path of its forward feeding movement without retreating from the material. Under these circumstances said lower feeding member ordinarily remained in contact with the material during at least a part of its return travel, and by reason of this contact, tended to drag the material with it in a direction opposite to its proper feed; and thereby the material was likely to be retracted somewhat after it had been fed, or to be wrinkled or otherwise displaced from its intended position. In order to avoid such difficulties as these, the present invention contemplates, as an important feature, the employment of coöperating feeding members, one above the other, the lower one of which is arranged to retreat from engagement with the material at the completion of a feeding movement. In this connection the specific improvements shown and described herein comprise coöperating feeding members both of which are arranged to retreat from engagement with the material at the completion of a feeding movement.

A preferred embodiment of this feature of the invention comprises what may be called for convenience a "double four-motion feed", *i. e.*, coöperating feeding devices each of which is given four motions for effecting one feeding movement and preparing for the next. The feeding members are first moved toward each other to engage the material between them; are then moved forward in unison to feed the material; are then moved apart to release it; and finally are returned to their initial positions preparatory to engaging the material anew.

One type of machine well known in the art includes a highly advantageous form of stretching mechanism for holding the material smooth while it is being acted upon. Said mechanism comprises a stretcher-foot and a coöperating cylindrical roller on a stationary axis, which engage the material between them. The stretcher-foot is moved laterally, preferably in the direction of feed of the material, to stretch the latter while it is held against bodily movement by another instrumentality. During this movement of the stretcher-foot the roller revolves in consonance with the stretching movement of the material. The stretcher-foot has a substantially plane acting surface and this acting surface presses the material against the cylindrical roller. Evidently, only a very small area of the cylindrical surface of the roller can contact with the material and this slight contact has been found insufficient to permit the roller properly to coöperate with the stretcher-foot. For example, a considerable force has been applied to one surface of the material by the stretcher-foot while practically none has been applied to the opposite surface by the roller, and consequently the action of the stretching force is applied unevenly, giving rise to a tendency to tear the material when the machine is being operated rapidly. Moreover the engagement between the stretcher-foot and roller was not sufficiently positive to insure their obtaining invariably an adequate stretching grip on the

material. These disadvantages are obviated by provisions of the present invention a feature of which comprises stretching means arranged to exert a uniform pull on all parts of the material engaged thereby.

A further feature of the invention comprises the combination of stretching devices arranged to engage the material between them by extended contact therewith, and means for moving said devices in substantially parallel paths for stretching the material.

Other features of the invention, and combinations of features, will be elucidated hereinafter and will be defined in the claims.

The invention will be described herein, for purposes of illustration, as embodied in a machine of the type shown in the patents above referred to; but nothing herein contained is to be construed as limiting the invention in the scope of its application to use in connection with this specific machine or in connection with machines of the same type.

In the drawings,—Figure 1 is an end elevation of the machine with certain parts broken away, the elements being shown in their proper relative positions at the termination of a feeding movement and the beginning of a stretching movement; Fig. 2 is a side elevation of the machine; Fig. 3 is a detail perspective of certain of the feeding instrumentalities viewed from a point slightly above the sheet in Fig. 2 and in the general direction indicated by the arrow 2, Fig. 2; Fig. 4 is a detail end elevation similar to Fig. 1, showing the elements in position at the end of a stretching movement; Fig. 5 is a detail side elevation of part of the stretcher mechanism; Fig. 6 is a detail section on the line 6—6 of Fig. 4.

In the operation of the specific machine shown in the drawings, the material rests upon a bed *a* supported by the base *b* of the machine. The material is introduced by placing it on the bed *a* (its edge in contact with an edge gage 10) in position to be engaged by the feeding devices. Thereafter the first cycle of operations of the machine serves to feed the forward end of the material into the path of a knife 11 which cooperates with a shearing-block 12 to snip the edge so as to facilitate folding if the edge be curved. The snipping takes place while the material is held stationary by a presser-foot 13, and during the return of the feeding devices preparatory to the next feed. The second cycle feeds the material another step forward so as to carry the snipped portion of the edge against a beveled folder-block 14 which turns said edge upwardly until slightly beyond a right angle to the body of the material. When the material is at rest again, another slit is made in its edge and the feeding devices return for a new feed. Succeeding cycles move the slitted and partly folded edge forwardly until it is in position to be acted upon by the forward end of a fold-presser 15 which presses the up-turned edge down on the body of the material, the edge being preferably coated with cement which causes the adjacent faces of the fold to adhere when pressed together. The fold-presser 15 performs its office when the material is at rest and while the knife 11 is snipping and the feeding devices are making their return trip. As the material progresses, its forward end is soon brought into association with the stretching devices which engage the material as a feeding movement ceases, and stretch it just before the fold-presser 15 acts. During this stretching operation the material is held on one side of the fold-presser by the stretching devices and on the other side by the presser-foot 13, the latter engaging the material simultaneously with its release by the feeding devices; and thus the material is held smooth to be pressed while the knife 11 makes another snip in that portion of the edge presented to it by the last feed movement. Thus the material guided by the operator with the assistance of the edge gage 10, is fed along and stretched so that its edge may be operated upon by the knife 11 coöperating with the shearing-block 12, by the presser-foot 13, the folder-block 14, and the fold-presser 15.

Preferably the devices just enumerated operate in substantially the same manner as in the machines of the patents aforesaid; and consequently it will suffice to describe them very briefly herein. The knife 11 is carried adjustably at the lower extremity of a plunger 16 which is reciprocated axially in its supporting brackets through the agency of an eccentric 17 rigid with the power-shaft 18 of the machine. An eccentric strap 19, encircling the eccentric 17, has an arm 20 which is attached to the knife-plunger 16 by means of a pivot 21 (see Fig. 1). The shearing-block 12 (see Fig. 2) is normally stationary and lies with its cutting edge immediately adjacent to the path of the knife 11; but said block may be withdrawn from this position, to interrupt the snipping operation when desired, by depressing a handle 22 with a result which is fully explained in the aforesaid Patent No. 713,657.

The presser-foot 13 is carried by a horizontally extending arm 23 secured to the lower extremity of the presser-foot plunger 24. This plunger 24 is reciprocated axially for actuating the presser-foot in a manner which will be elucidated hereinafter in connection with the feeding devices.

The folder-block 14 may be formed as

shown in the aforesaid patents. Preferably it consists merely of a block, rigid with the bed *a*, having a vertically disposed bevel of suitable conformation to turn up the edge of the material as it is presented thereto.

The fold-presser 15 is supplied by one arm of a bell-crank lever 25 which is pivoted to a bracket 26 and is rocked through the agency of a link engaging an eccentric 27 on the power-shaft 18. Normally the rocking of the fold-presser 15 serves to fold down the upturned edge of the material and to press the fold against the bed *a*, but this action may be suspended at will by lifting a handle 28, thereby actuating certain devices (fully described in said patents) which elevate the pivot of the fold-presser and render its rocking ineffective.

The present invention is more particularly concerned with the instrumentalities which control the material during the course of operation of the devices just alluded to. The former include the feeding devices and the stretching devices. The feeding devices comprise an upper feed-foot A and a lower feed-foot B, and the stretching devices comprise an upper stretcher-foot C and a lower stretcher-foot D.

The upper feed-foot A is preferably integral with an arm 29 of a feed-frame *c* which is secured at the lower extremity of a feed-plunger *d* (see Fig. 3). The feed-frame *c* has also arms 30 and 31, the former bearing an adjustable pin which fits in an elongated slot in the arm 20 of the eccentric strap 19. The arm 31 extends downwardly through an appropriately formed aperture in the bed *a* and is associated as presently described with the lower feed-foot B. The feed-frame *c* is arranged to be oscillated in a plane perpendicular to the axis of the feed-plunger *d*. This oscillation of the feed-frame is effected through the co-action of the eccentric-strap arm 20 and the feed-frame arm 30. During the elevation of the knife-plunger 16 through the agency of the eccentric 17, the arm 20 is also elevated and during a part of its upward travel (see arrow 32, Fig. 3) its elongated slot acts on the pin of arm 30 to move the latter in the direction of arrow 33 Fig. 3. This serves to move the entire feed-frame about the axis of the feed-plunger *d* and thereby both feed-feet A and B are moved in the direction of arrow 34 of Fig. 3. This constitutes the forward feeding movement of the feed-feet and it takes place after they have been moved toward each other for engaging the material between them. The lower feed-foot B is preferably integral with a carrier *e* which is supported at its opposite ends by a roller 35 and a cam *f* respectively. The roller 35 has a stationary axis provided by a screw which threads into the base *b*; and said roller is engaged by oppositely disposed bifurcations in the end of the carrier *e* in such a manner as to leave the latter free to reciprocate lengthwise (see Fig. 1). The opposite end of the carrier *e* presents a finger 36 which overlies the acting face of the cam *f*. A spring-pressed knob 37 abuts against the finger 36 to hold it against the cam *f* and to depress it when said cam permits (see Figs. 1 and 3). A vertical cylindrical hub *g* is rotatably supported on the carrier *e*, the upper end of said hub seating in a cylindrical recess in the body of the feed-foot B (see Fig. 3) and the lower end being journaled in the lower part of the carrier. The head of a screw 38 underlies a portion of the hub *g* and prevents its dropping away from its seat; and said hub is supplied with a handle 39 for facilitating its removal when the screw 38 has been withdrawn. The hub *g* is bifurcated throughout the greater part of its length to provide an elongated slot for the reception of a pin rigid with the feed-frame arm 31 (see Figs. 1, 3 and 4). Evidently, with this arrangement the carrier *e* is forced to reciprocate endwise when the feed-frame *c* is oscillated as already described; and thus the upper and lower feed-feet A and B are moved in unison, forwardly for feeding the material and rearwardly preparatory to re-engaging the material.

During a forward feeding movement the acting face of the lower feed-foot B is substantially flush with the top of the bed *a*; the cam *f*, which is constructed to suit this purpose, being then in the position shown in Fig. 1. This cam is pivoted at 40 to a bracket rigid with the base *b*, and is connected by a link 41 to a crank *h* on a rock-shaft *i*. The rock-shaft *i* is oscillated through the agency of a crank 42 and link 43 which connect said shaft with an eccentric *j* on the power-shaft 18 (see Fig. 2).

In order to permit adjustment of the cam *f*, for altering the positions determined by it for the lower feed-foot B, said cam is provided with an eccentrically supported pivot 40 (see Fig. 6). One end of the pivot is preferably provided with a slot for a screw-driver (see Fig. 1) to facilitate turning the pivot and thereby shifting the eccentric so as to adjust the cam upwardly, downwardly or horizontally. A set-screw is provided for securing the pivot in adjusted position. In order to permit ready withdrawal of the eccentric pivot 40, it is journaled at one end in a sleeve (Fig. 6) which fits easily within an enlarged aperture in the supporting bracket of the cam *f*. The set-screw projects through a hole in this sleeve and bears against one end of the eccentric supporting shaft of said pivot to hold it in adjusted position. When the set-screw is removed the sleeve and pivot may be easily

withdrawn through the enlarged aperture in the bracket.

As shown in Fig. 1, the feed-feet A and B have just completed a forward feeding movement and are about to commence their return. The power-shaft 18 is driven constantly in the direction indicated by arrow 44 Fig. 1. The coöperation of the various elements is so timed that, when a forward feed ceases, the cam *f* is rocked in the direction of arrow 45 (Figs. 1 and 2) until it reaches the position shown in Fig. 4 wherein the lower portion of its acting face is brought benea' the finger 36 to permit the spring-pressed knob 37 to depress said finger for retracting the lower presser-foot B downwardly, and removing it from contact with the material. At about the same time the feed-frame *c* begins its return movement in a direction opposite to arrow 34 in Fig. 3 in order to prepare for a new engagement of the material for the next feed. In the meantime the upper feed-foot A is also withdrawn from contact with the material by being moved upwardly in a manner about to be described.

The movement of the upper feed-foot A to the end just referred to, originates with the eccentric 17 which reciprocates the knife-plunger 16 and thereby rocks a lever 46 (see Fig. 2). This lever is rocked alternately on shifting fulcra supplied by the connecting-pins of the presser-foot plunger 24 and the feed-plunger *d*, respectively. A heavy leaf-spring 47 bears constantly downwardly on an abutment 48 rigid with the lever 46. A lifter 49 is pivotally secured to the lever 46 and is arranged to coöperate with a stationary shelf 50 for elevating both the presser-foot plunger and feed-plunger to permit the material to be introduced readily beneath the presser-foot and upper feed-foot. The construction and mode of operation of the devices just described are well known in the art and it will suffice to say that when the knife-plunger is elevated by the eccentric 17, the presser-foot is lifted and the upper feed-foot is held down by the spring 47; and when the knife-plunger is depressed said feed-foot is elevated and the presser-foot is held down by said spring. The co-action of the various parts of the mechanism is such that the upper and lower feed-feet are retreated from the material at substantially the same time.

When the feed-feet have returned for engaging the material anew, the upper feed-foot is depressed in the manner just suggested and the lower feed-foot is elevated by movement of the cam *f* from the position shown in Fig. 4 to that shown in Fig. 1, this movement taking place in a direction opposite to arrow 45 (Fig. 1). In this manner the feed-feet are caused to move together for engaging the material firmly between them. Thereafter the feed-frame *c* is rocked in the direction of arrow 34 (Fig. 3) for feeding the material. At the end of a feed movement the stretching devices initially engage the material.

The upper stretcher-foot C is supplied by a projection at the lower end of a spring-pressed socket *k* (see Fig. 4) which encircles a cylindrical pin *l* secured to a bracket *m*. A coil spring is interposed between an annular shoulder on the pin *l*, and the floor of the socket *k*. A lug *n* (Fig. 5) projecting laterally from the top of the socket *k*, is threaded to receive an adjusting screw 51 which passes through an aperture in a portion of the bracket *m*. The head of the screw 51 abuts upon the upper surface of said portion of the bracket (see Figs. 4 and 5). Thus the screw 51 limits the downward movement of the stretcher-foot C under the influence of its spring; and by turning said screw this limit may be changed at will thereby contributing to the adjustment of the pressure with which the stretcher-foot engages the material. The bracket *m* is adjustably secured to a connecting-rod *o* which passes through a freely rotatable stud *p* journaled in a bracket supplied by the frame of the machine. The upper end of said connecting-rod *o* is pivoted to an eccentric *q* on the power-shaft 18. The bracket *m* has a sleeve encircling the connecting-rod *o* and a set-screw in said sleeve secures the bracket in position, and permits adjustment of the stretcher-foot toward and from the bed *a* (see Fig. 1).

The outline of the power-shaft 18 is shown in Fig. 1 so that the positions of the eccentrics relative thereto may be readily observed. The eccentric *q* is so disposed that the stretcher-foot C is first moved, from the position shown in Fig. 1, in the direction of arrow 52; is then moved upwardly away from the material; is returned to position for reëngaging the material; and is lastly moved downwardly into the position shown in Fig. 1. Fig. 4 shows the stretcher-foot C just after it has been lifted from the material.

The lower stretcher-foot D is supplied by the upper end of a lever *r* fulcrumed at 53 upon a bracket rigid with the base *b*. The lower end of the lever *r* is connected by a link 54 to a short crank 55 on the rock-shaft *i* the movement of which causes the stretcher-foot D to oscillate in consonance with the movement of the upper stretcher-foot C.

The lower stretcher-foot D moves on a stationary axis and consequently its path is the arc of a circle. The curvature of this path is rendered immaterial, however, by the yielding character of the support of the upper stretcher-foot C which presses the lat-

ter constantly against the material as the two stretcher-feet move together to perform their stretching office. The two stretcher-feet move in unison when they have engaged the material between them and consequently they exert substantially equal pulls upon it, thereby diminishing the likelihood of tearing the material.

The machine is driven through one of a series of belt pulleys 56 rigid with the power shaft 18. Preferably the various parts of the mechanism are in the positions shown in Fig. 4 when the material is first introduced. For greater convenience, the upper feed-foot A and the presser-foot 13 may be elevated by means of the lifter 49 and then released again after the material has been properly inserted. The first action of the machine then serves to move the feed-feet A and B toward each other to engage the material. It will be noted (see Fig. 1) that the eccentrics 17 and *j* are oppositely disposed on the shaft 18 and consequently, as said shaft moves in the direction of the arrow 44, the arm 20 will be elevated while the link 43 is being depressed, and vice versa. When the parts are in the positions indicated in Fig. 4 the line of centers of eccentrics 17 and *j* is substantially vertical, the link 43 being at about the limit of its upward movement; and, therefore, further rotation of the shaft 18 moves said link downwardly thereby rocking the crank 42 and the crank *h*, and moving the link 41 so as to rotate the cam *f* in a direction opposite to the arrow 45 in Fig. 1. This elevates the feed-foot B. Concurrently with the downward movement of the link 43, the arm 20 is slightly elevated thereby lifting the knife-plunger 16 and rocking the lever 46 with the result that the feed-plunger and upper feed-foot are depressed. Thus the feed-feet are brought together upon opposite sides of the material which is yieldingly engaged between them by reason of the upper feed-foot A being held down by the tension of the spring 47. During the movement just described, the knife 11 is elevated slightly; the fold-presser 15 is lifted from a previously assumed pressing position; the presser-foot 13 remains stationary; and the stretcher-feet C and D are separated and begin their return travel preparatory to the next engagement of the material. All these movements take place during approximately one-sixth of a revolution of the shaft 18.

At the time the material is finally grasped by the feed-feet, the slot in the arm 20 is disposed obliquely to the vertical; and further upward movement of said arm moves the pin on arm 30, and therethrough the feed-frame *c*, so as to carry the feed-feet in unison in the direction of arrow 34, (Fig 3) for feeding the material. This feeding movement is completed at approximately the end of the first half revolution of the shaft 18; and it is accompanied by further elevation of the knife 11, lifting of the presser-foot 13 which begins to rise immediately the feed commences, elevation of the fold-presser 15 to its uppermost limit of travel, and the return of the stretcher-feet C and D to their final positions preparatory to engaging the stock.

The feed-feet remain temporarily stationary, in engagement with the material, at the end of a feed movement, while the knife 11 descends to snip the edge, bringing with it the presser-foot 13. As soon as the latter seats against the material the upper feed-foot A is lifted and concurrently the lower feed-foot B is depressed so that both are removed from active engagement with the material (see Fig. 4). During these actions the fold-presser 15 has begun to move downwardly and the stretcher-feet have engaged the material and begun their active stretching movement (assuming, for convenience, that the material has progressed far enough to be engaged by the stretcher-feet). Thus far the shaft 18 has advanced through approximately three-fourths of a revolution bringing the parts into the positions shown in Fig. 1.

As already stated the feed-feet do not depart from the material until the presser-foot has firmly engaged it, and hence it is constantly engaged by one or the other. During approximately the last quarter revolution of the shaft 18, the stretcher-feet C and D complete their stretching movement just before the fold-presser performs its pressing office, the material being held against bodily movement by the presser-foot; and then the upper stretcher-foot C is lifted from the material. At the same time the feed-feet are separated until they disengage the material and are returned to their initial positions. Thus all the parts resume, at the end of the cycle, the positions shown in Fig. 4.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In a machine of the class described, the combination of coöperating feed-feet; a feed-frame for controlling one of said feet; means independent of the feed-frame for elevating and depressing the other feed-foot; and actuating mechanism for said parts.

2. In a machine of the class described, the combination of coöperating feed-feet; an adjustable cam for elevating one of said feet; a spring for depressing said foot; a feed-frame for controlling the other foot and for causing both feed-feet to feed the material; and actuating mechanism for said parts.

3. In a machine of the class described, the

combination of coöperating feed-feet; a movable feed-frame for controlling one of said feet; a pivoted carrier for the other foot, arranged to be moved endwise by the feed-frame; means for rocking said carrier on its pivot; and actuating mechanism for said parts.

4. In a machine of the class described, the combination of coöperating feed-feet; a movable feed-frame for controlling one of said feet; a pivoted carrier for the other foot, arranged to be moved endwise by the feed-frame; adjustable means for rocking said carrier on its pivot; and actuating mechanism for said parts.

5. In a machine of the class described, means to feed material to be folded, means to fold the material, means to stretch the material comprising an upper and a lower engaging member, and actuating mechanism to move the lower engaging member independently of the upper engaging member but in unison therewith to stretch the material.

6. In a machine of the class described, feeding means, folding means, stretching means, and actuating mechanism therefor, said stretching means comprising coöperating engaging devices to engage the material to be stretched between them, and said actuating mechanism including means for moving the coöperating engaging devices in unison to stretch the material engaged by them.

7. In a machine of the class described, feeding means; folding means; coöperating stretching devices arranged for movement in substantially parallel paths for stretching the material; actuating mechanism for said parts arranged to cause the stretching devices to engage the material when it has been fed, to stretch the material before the folding means has completed its operation, and to hold the material stretched until the folding means has completed its operation; and means for holding the material against bodily movement while the stretching devices perform their office.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RICHARD H. LUFKIN.

Witnesses:
LAURENCE A. JANNEY,
ARTHUR L. RUSSELL.